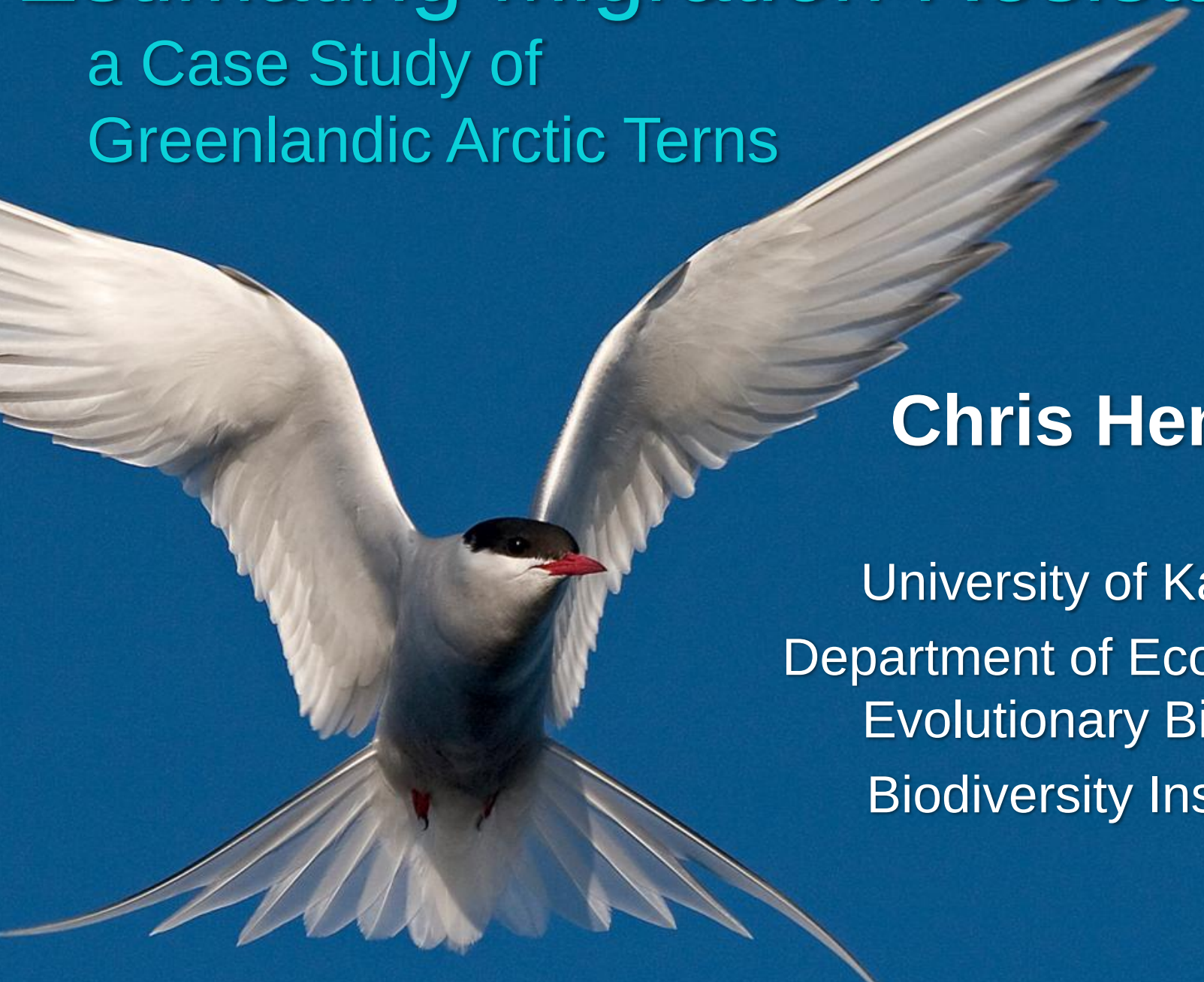
Estimating Migration Resistance:

a Case Study of Greenlandic Arctic Terns



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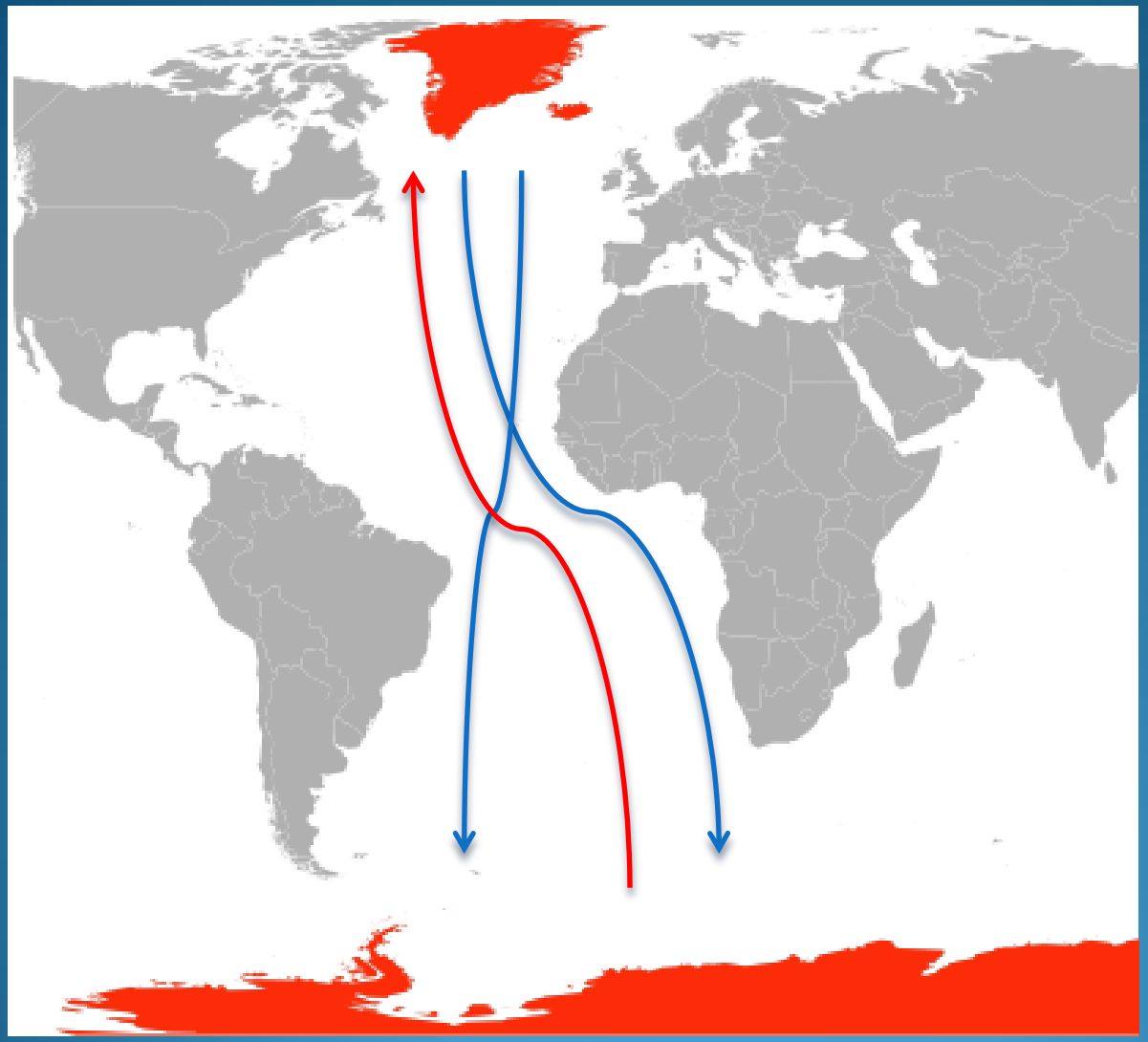
The Problem

1: How do migratory animals choose their travel routes?

2: What variables are responsible for navigation choices?

3: How can we incorporate high-quality tracking data?

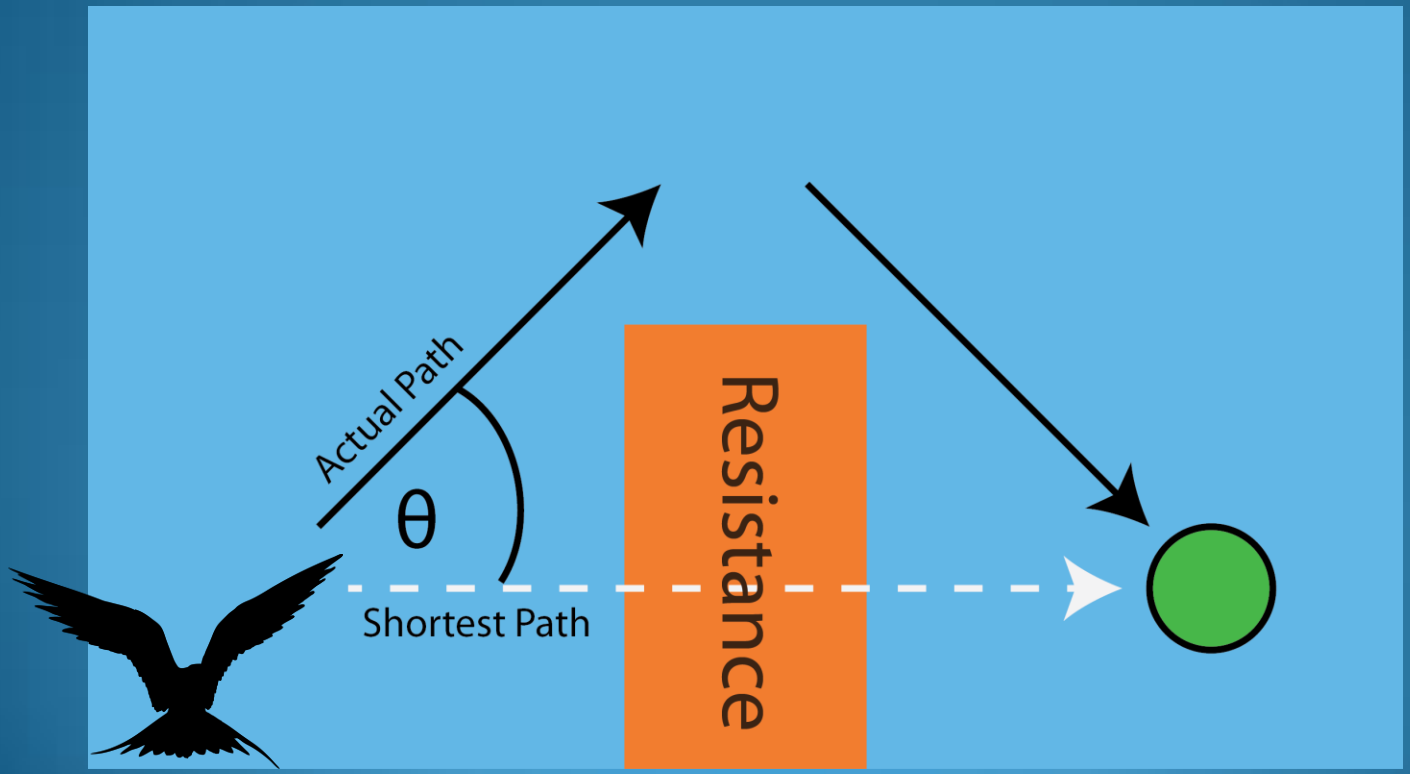
Data



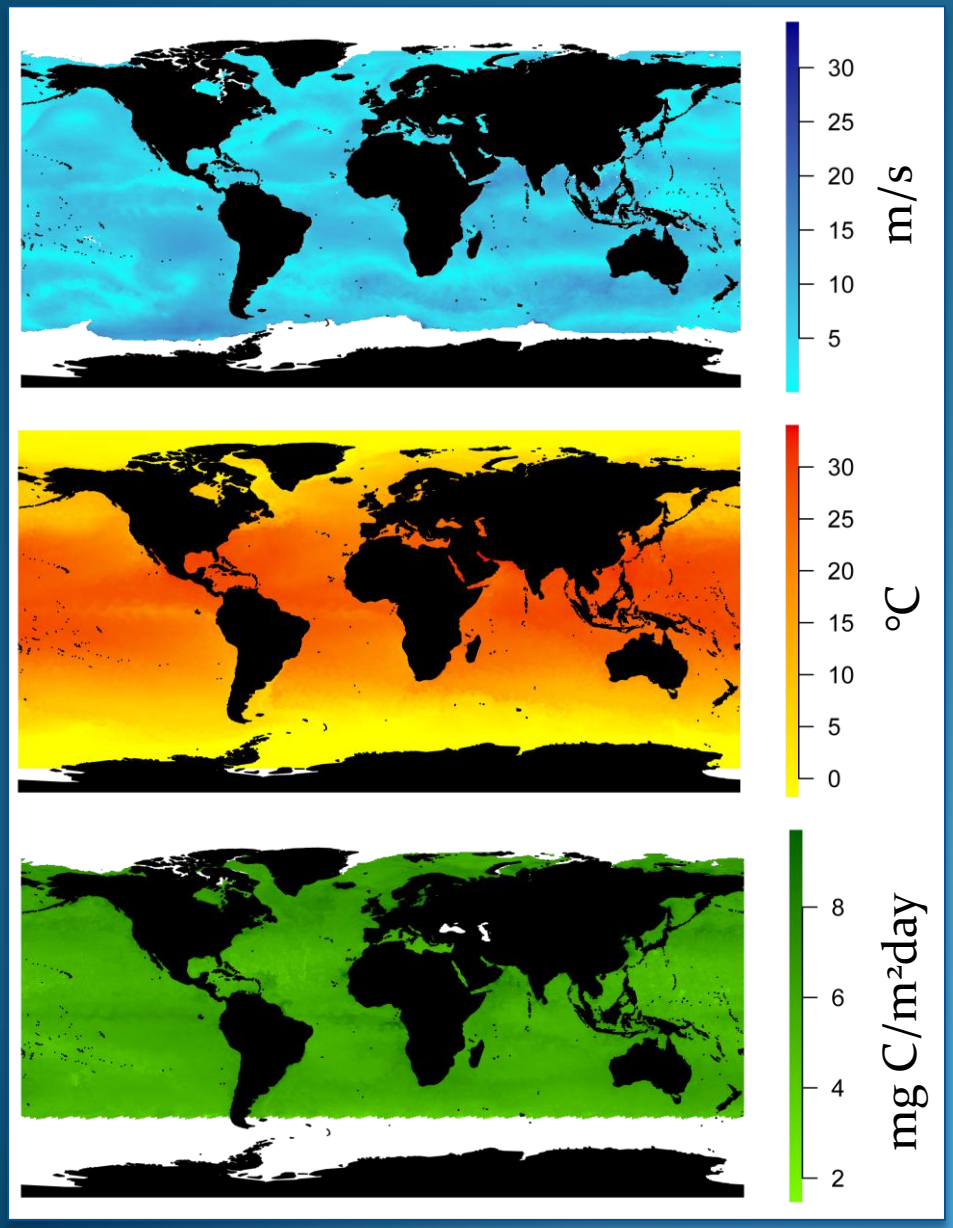
(Egevang 2010)

Methods

- Compare actual travel path with shortest distance path
- Measure differences in environments along both paths



Data



- Remote sensing:
  - CCMP ocean winds
  - AVHRR temperature
  - AVHRR sea ice
  - NPP layer 4 product
- Models:
  - Linear exploration
  - Circular-linear regression
  - Non-linear regression

Models

Southern Migration, 9 birds, n=929

Variable	Coefficient	Std Error	T	P
Wind Actual	-0.04	0.005	-8.09	<0.0001
Wind Optimal	0.017	0.007	2.39	0.017
SST Actual	-0.161	0.02	-8.15	<0.0001
SST Optimal	0.152	0.02	7.72	<0.0001
NPP Actual	-0.261	0.087	-3.01	0.003
NPP Optimal	0.234	0.089	2.64	0.009

Northern Migration, 9 birds, n=629

Variable	Coefficient	Std Error	T	P
Wind Actual	0.047	0.008	6.15	<0.0001
Wind Optimal	0.003	0.008	0.37	0.711
SST Actual	0.058	0.02	2.91	0.004
SST Optimal	-0.061	0.02	-2.99	0.003
NPP Actual	-0.03	0.106	-0.29	0.774
NPP Optimal	-0.022	0.113	-0.20	0.846

- Implemented in R
- Models:
  - Linear exploration

Future Directions

1: Finish non-linear model

2: Generalize procedure and include additional species

3: Project resistances into future climates and land-use scenarios

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